

CLAIMS

What is claimed is:

1. A residue-free contact opening in a dielectric layer for a semiconductor device formed by a method comprising:
- 5 providing a semiconductor substrate having a conductive pad;
forming said dielectric layer over said semiconductor substrate and said conductive pad
with at least one opening extending from an upper dielectric layer surface to
said conductive pad and including a residue residing within said at least one
opening;
- 10 applying nitric acid within said at least one opening; and
subsequently applying a phosphoric acid containing solution within said at least one
opening.
2. A contact within a residue-free opening in a dielectric layer for a
semiconductor device formed by a method comprising:
- 15 providing a semiconductor substrate having a conductive pad;
forming said dielectric layer over said semiconductor substrate and said conductive pad
with at least one opening extending from an upper dielectric layer surface to
said conductive pad, and wherein a residue resides within said at least one
opening;
- 20 applying a nitric acid within said at least one opening;
subsequently applying a phosphoric acid containing solution within said at least one
opening; and
disposing conductive material within said at least one opening.
- 25 3. A residue-free contact opening in a dielectric layer and a barrier layer
for a semiconductor device formed by a method comprising:
providing a semiconductor substrate having a conductive pad;
forming said barrier layer over said semiconductor substrate and said conductive pad;

forming said dielectric layer over said barrier layer;
forming a first via portion through said dielectric layer to expose a portion of said
barrier layer, said formation of said first via portion forming an oxide polymer
residue within said first via portion;
5 forming a second via portion through said exposed portion of said barrier layer, said
formation of said second via portion forming a metal polymer residue within
said first and second via portions;
applying nitric acid within said first and second via portions to remove said metal
polymer residue; and
10 subsequently applying a phosphoric acid containing solution within said first via
portion to remove said oxide polymer residue.

4. A residue-free contact opening in a dielectric layer and a barrier layer for a
semiconductor device, formed by a method comprising:

15 providing a semiconductor substrate having a conductive pad;
forming said barrier layer over said semiconductor substrate and said conductive pad;
forming said dielectric layer over said barrier layer;
forming a first via portion through said dielectric layer to expose a portion of said barrier
layer, said formation of said first via portion forming an oxide polymer residue
20 within said first via portion;
applying a phosphoric acid containing solution within said first via portion to remove said
oxide polymer residue;
forming a second via portion through said exposed portion of said barrier layer, said
formation of said second via portion forming a metal polymer residue within said
25 first and second via portions; and
applying a nitric acid containing solution within said first and second via portions to
remove said metal polymer residue.

5. A residue-free contact opening in a dielectric layer for a semiconductor device formed by a method comprising:
providing a semiconductor substrate having a conductive pad;
forming said dielectric layer over said semiconductor substrate and said conductive pad
with at least one opening extending from an upper dielectric layer surface to said
conductive pad, and wherein a residue resides within said at least one opening;
applying nitric acid within said at least one opening; and
subsequently applying a phosphoric acid solution including a fluorine containing
component within said at least one opening.

6. A contact within a residue-free opening in a dielectric layer for a semiconductor device formed by a method comprising:
providing a semiconductor substrate having a conductive pad;
forming said dielectric layer over said semiconductor substrate and said conductive pad
with at least one opening extending from an upper dielectric layer surface to said
conductive pad, and wherein a residue resides within said at least one opening;
applying a nitric acid within said at least one opening;
subsequently applying a phosphoric acid solution, including a fluorine containing
component, within said at least one opening; and
disposing conductive material within said at least one opening.

7. A method of fabricating a contact opening in a dielectric layer and a barrier layer for a semiconductor device, comprising:
providing a semiconductor substrate having a conductive pad;
forming said barrier layer over said semiconductor substrate and said conductive pad;
forming said dielectric layer over said barrier layer;
forming a first via portion through said dielectric layer to expose a portion of said barrier
layer, said formation of said first via portion forming an oxide polymer residue
within said first via portion;

forming a second via portion through said exposed portion of said barrier layer, said
formation of said second via portion forming a metal polymer residue;
applying nitric acid within said first and second via portions to remove said metal
polymer residue; and
5 subsequently applying a phosphoric acid solution including a fluorine containing
component within said first via portion to remove said oxide polymer residue.

8. A residue-free contact opening in a dielectric layer and a barrier layer for a
semiconductor device formed by a method comprising:

10 providing a semiconductor substrate having a conductive pad;
forming said barrier layer over said semiconductor substrate and said conductive pad;
forming said dielectric layer over said barrier layer;
forming a first via portion through said dielectric layer to expose a portion of said barrier
layer, said formation of said first via portion forming an oxide polymer residue
15 within said first via portion;
forming a second via portion through said exposed portion of said barrier layer, said
formation of said second via portion forming a metal polymer residue within said
first and second via portions;
applying nitric acid within said first and second via portions to remove said metal
20 polymer residue; and
subsequently applying a phosphoric acid solution including a fluorine containing
component within said first via portion to remove said oxide polymer residue.

9. A residue-free contact opening in a dielectric layer and a barrier layer
25 for a semiconductor device formed by a method comprising:
providing a semiconductor substrate having a conductive pad;
forming said barrier layer over said semiconductor substrate and said conductive pad;
forming said dielectric layer over said barrier layer;

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forming a first via portion through said dielectric layer to expose a portion of said barrier layer, said formation of said first via portion forming an oxide polymer residue within said first via portion;
applying a solution including a fluorine containing component within said first via portion to remove said oxide polymer residue;
forming a second via portion through said exposed portion of said barrier layer, said formation of said second via portion forming a metal polymer residue within said first and second via portions; and
applying nitric acid within said first via and second via portions to remove said metal polymer residue.

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